MTO MEMS

TUNNEL TO SPACE

AFRL

A Notional Concept

For Low Cost

Rapid Access

To Space

By

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4 April 2002

At JPL

JPL

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TUNNEL TO SPACE

AFRL

- An integrated NASA/DoD (STP), JPL/Aerospace, Cubesat Community
- Rapid Low cost access to space for Cubesat and PICOSAT builder
  - Form Factor: 4” x 4” x L)
- Shuttle Flight Sponsorship by STP (with DoD endorsement) or NASA
- Launched via the JPL/Aerospace STS–approved launcher
- Only ΔPhase-3 Safety review is newly required for flight
- Can take advantage of late term flight opportunities
- Guidance for design compliance, qual testing and STS interface provided as needed by JPL/Aerospace/Stanford and STP JSC team
- A stepping stone to other derived configurations for launching miniature satellites
- First PICOSAT flight form the launcher enabled in Calendar 02
- First Cubesat candidates to be briefed to SERB in November 2002

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PICOSAT/MEPSI Project

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- Funded by DARPA-MTO
  - Advance space utilization/exploitation of MEMS and microsystems
  - Create infra-structure for PICOSAT space operations and dedicated ground stations
  - Conduct progressive development of MEMS technology leading to MEPSI and fully functional miniature satellite
- AFRL/IF and JPL are Prime on MEPSI
  - AFRL secured 6 space flights including 3 STS
  - Coordinated funding for component development
- JPL and Aerospace are Implementing Agents
- STS NSRP Coordination and status
  - Launcher and PLA approvals well along
  - **PICOSAT Launcher will be acceptable for reflight**

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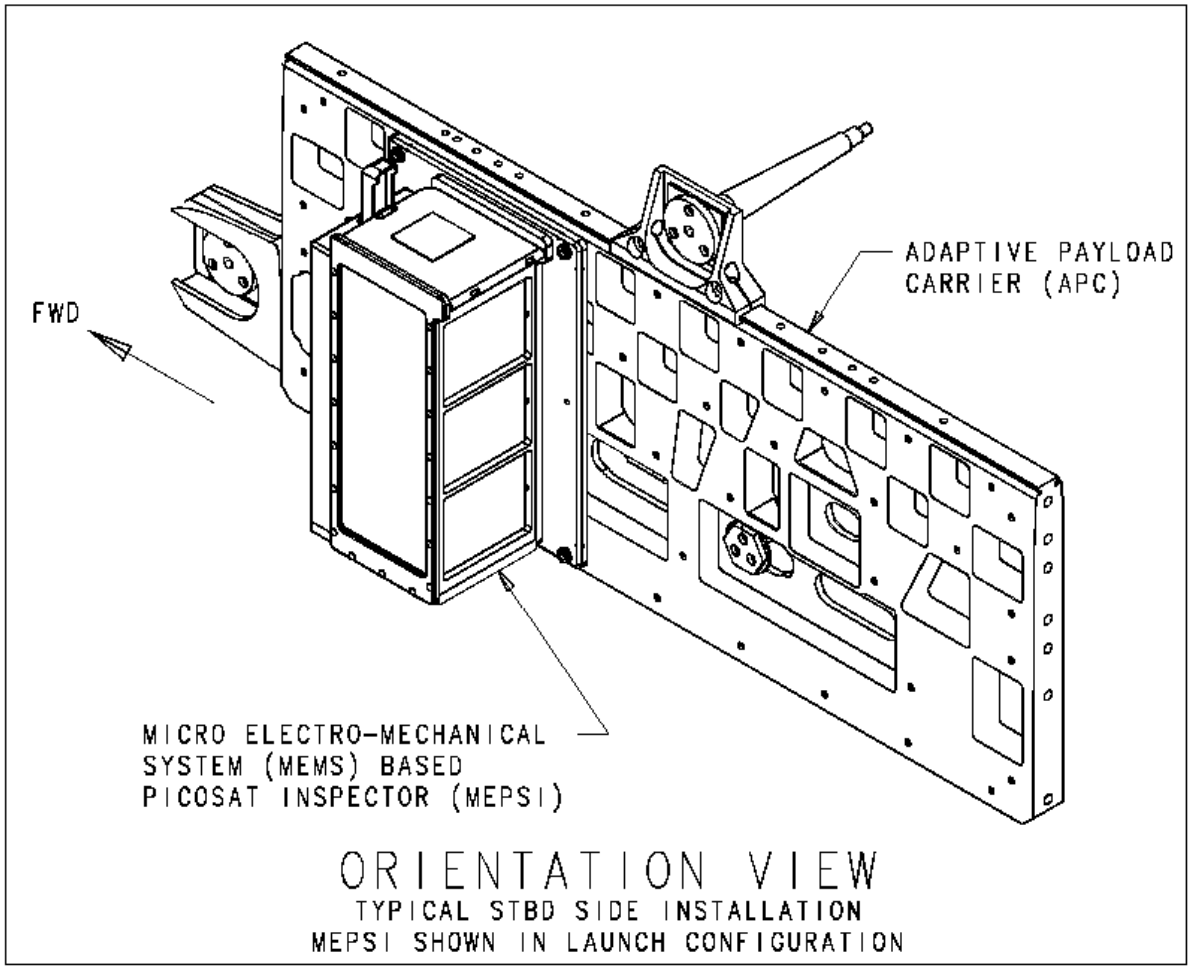
STS/PICO-1 in Cargo Bay



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The “Tunnel”

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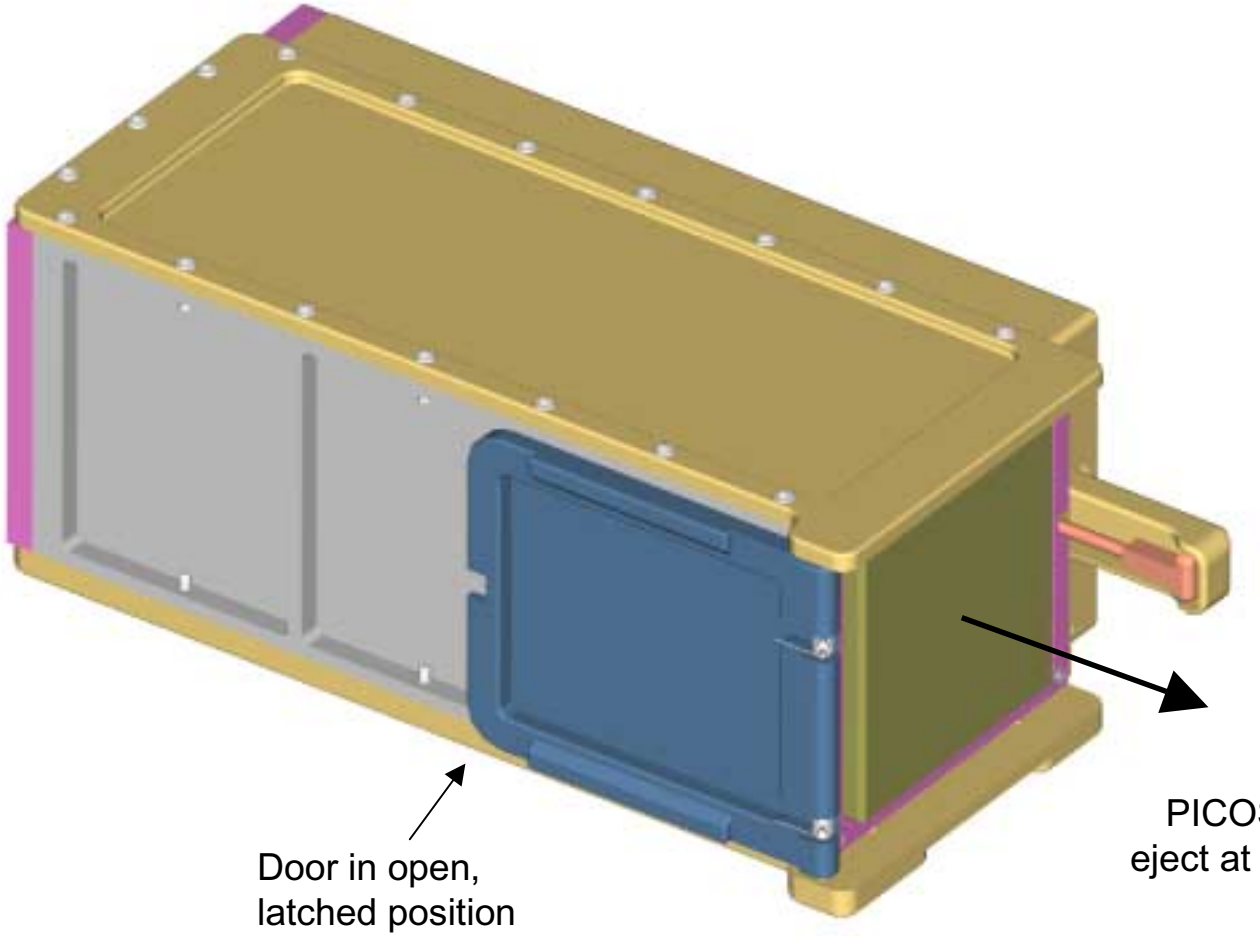

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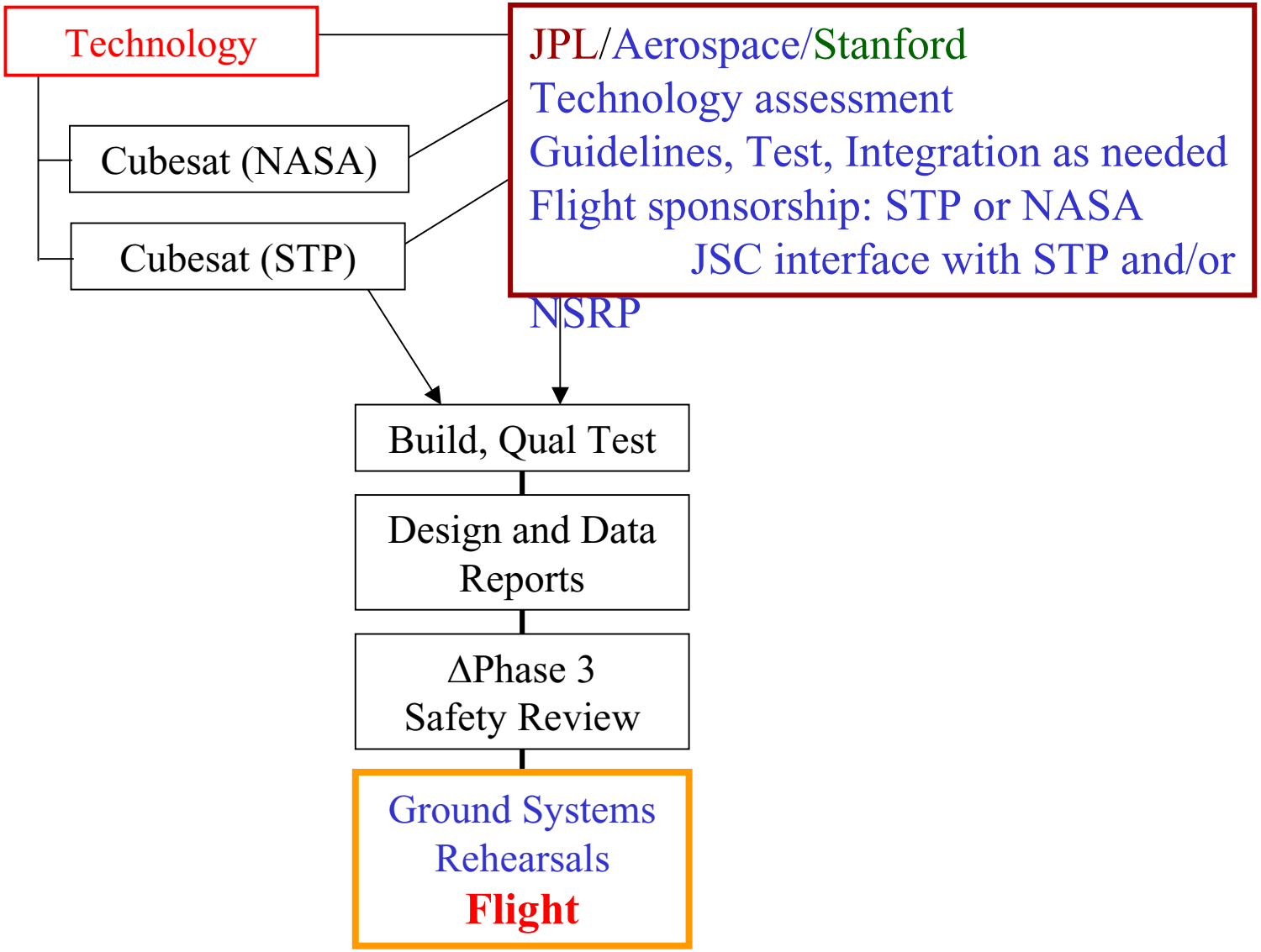
Low Cost Path to Space



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Update of PICSOAT NASA Docs

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- Modify approved PICOSAT Docs
  - PRD, PIP, ICD, Design drawing and controls, Materials traceability and controls, FCP, SVP, MSVP, FSDP + HRs, GSDP,
- Test plans, Analyses, Tests, Reports
- Qualification Testing
- Delta-Phase-03 Safety Review
  - Avoid additional Hazard Reports

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Process

- PICOSAT/Cubesat scale technology of interest to DoD is briefed to SERB (initially with JPL/Aerospace interface)
- NASA partner sponsors other PICOSAT/Cubesat Missions
- JPL/Aerospace interact with experimenter to ensure compliance with NSRP
- The cargo element comprises two parts: the launcher and the ejected PICOSATs. Only PICOSATS are new.
- If successful, a path is blazed for all PICSOAT/Cubesat
  - space flight at minimal cost
  - rapid access, and max flexibility enables use of late blooming STS flight opportunities
  - Leads to new culture for PICOSATs at NASA-JSC
- DoD benefits from accelerated pace of space technology
- NASA benefits also from broad outreach to academia and public

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Next Steps

- Convince DARPA/AFOSR/NASA agencies to coordinate space experiment funding that can exploit the *TUNNEL TO SPACE*
- Explore participation by other agencies
  - Other DoD agencies
  - University Space Grant Consortium
  - National Space Grant Student Satellite Program
  - NASA Outreach Programs
  - NASA Bioexplorer and BioNanosat Program
  - University Space Research Association
  - etc

Backup Charts

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MEMS Relay Multi-chip Module
developed to fire PICOSAT microthrusters

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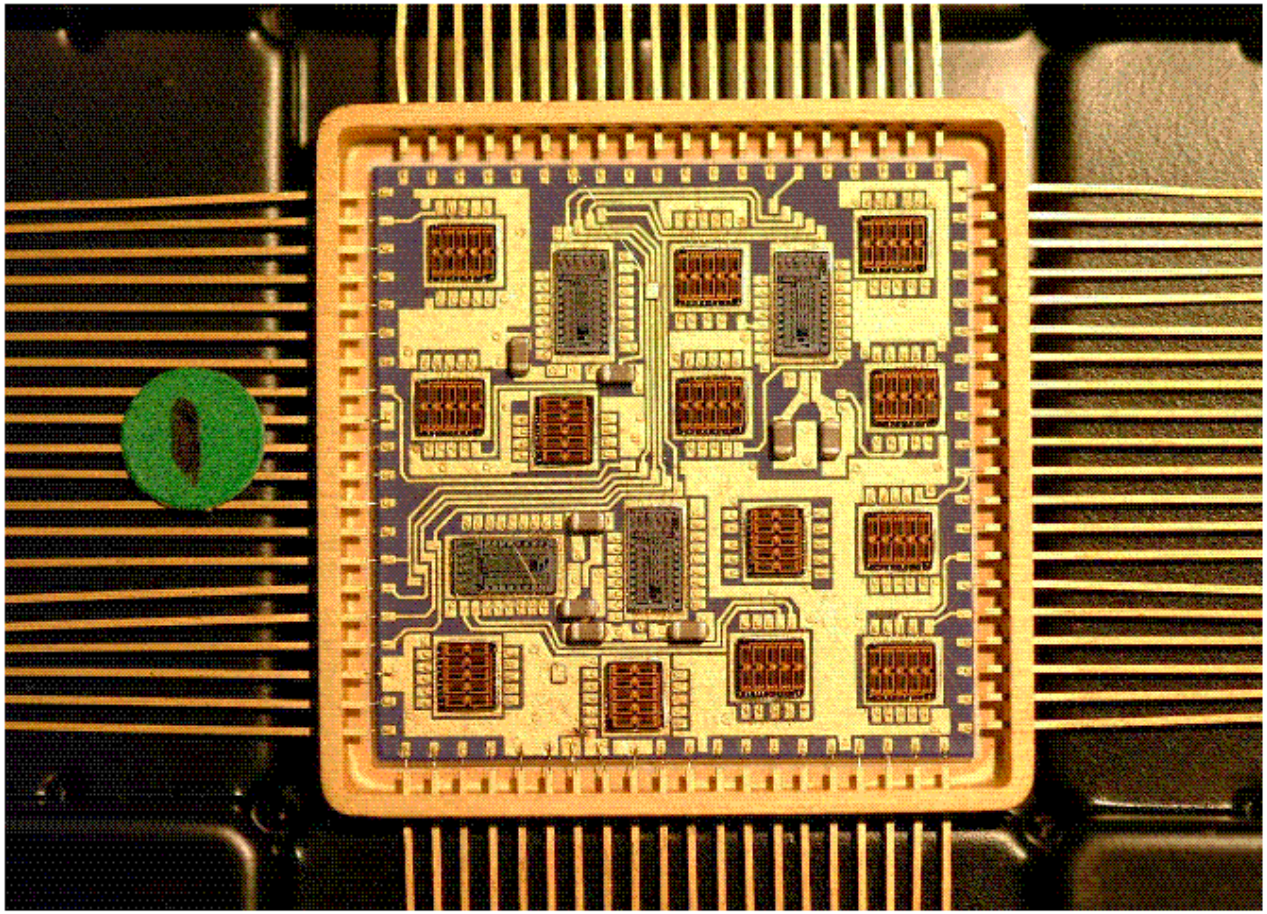

25-Oct-01

AFRL contract: F30602-01-M-VD05

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SolarMast Cubesat

STANFORD/Lockheed/Aerospace Team

Thin Film Solar Cells on Deployablw Flexible substrate

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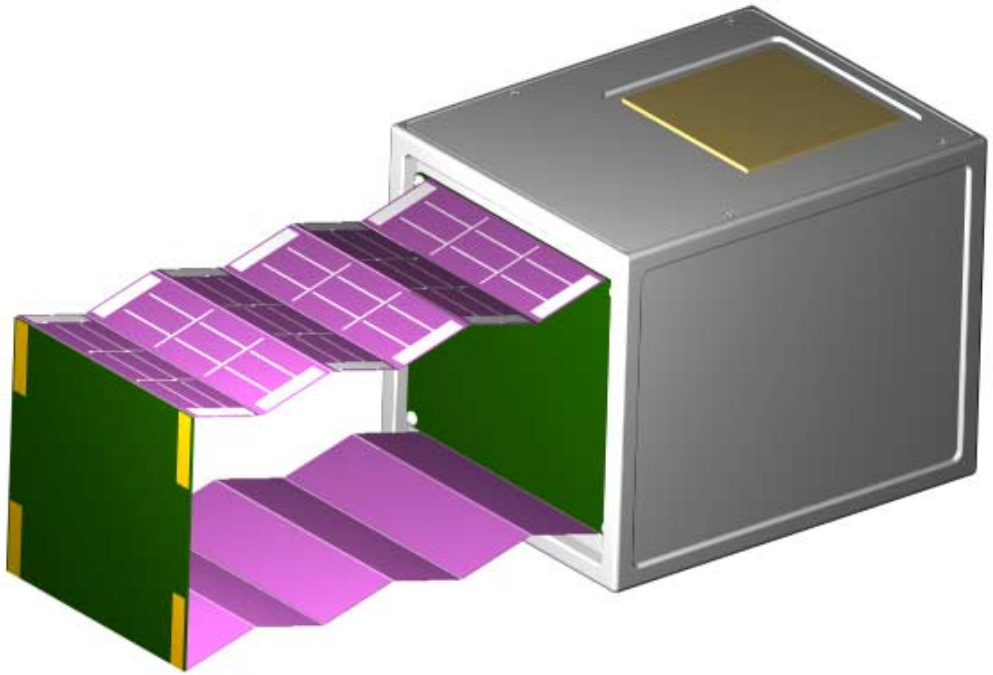

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Cold Gas Micropropulsion Module

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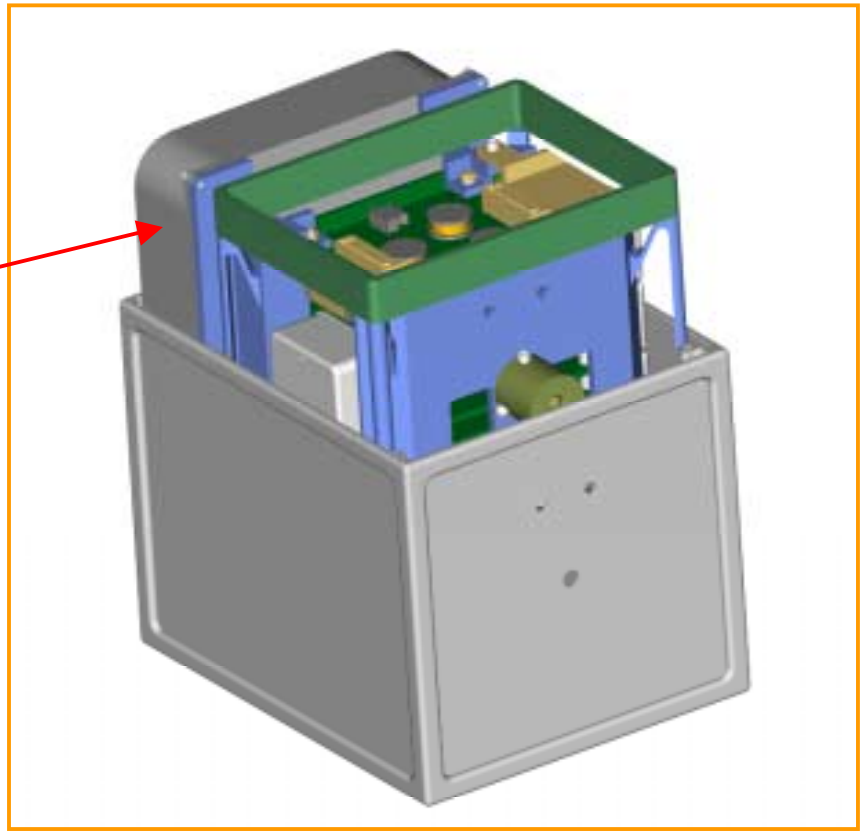
PICOSAT or Cubesat



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